FOR ONLINE PUBLICATION

ONLINE APPENDIX

DOES MEDICAL MALPRACTICE LAW IMPROVE HEALTH CARE QUALITY?

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Online Appendix A: Data Sources, Quality Measures, and Covariates

National Hospital Discharge Survey

Healthcare quality data is collected from the National Hospital Discharge Survey (NHDS), a nationally-representative sample of inpatient discharge records from short-stay, non-federal hospitals. For approximately 260,000 inpatient records per year, the NHDS contains information on, among other things: (a) primary and secondary diagnosis and procedure codes, (b) certain demographic characteristics of the patient, and (c) certain characteristics of the hospital. We supplement the public NHDS files with geographic identifiers (restricted-use variables) received pursuant to an agreement with the Research Data Center (RDC) at the National Center for Health Statistics (NCHS). All empirical work was performed onsite at the RDC in Hyattsville, Maryland. The resulting sample covers the years 1979 to 2005.

Healthcare Quality Measures

For the purposes of this study, we largely look to the AHRQ for guidance in selecting quality metrics. The AHRQ measures are particularly useful for the present study insofar as they are designed for use with administrative inpatient databases such as the NHDS. The AHRQ's quality indicators are essentially classified into 3 modules: (1) Prevention Quality Indicators (PQIs), identifying admissions that could have been avoided through access to high-quality outpatient care, (2) Inpatient Quality Indicators (IQIs), reflecting the quality of care inside hospitals including inpatient mortality for certain medical conditions, and (3) Patient Safety Indicators (PSIs), focusing on potentially avoidable complications during inpatient care.

For the purposes of this analysis, we attempt to construct quality metrics that are meant to cover each of these three domains.

Avoidable hospitalizations. First, we calculate a rate of avoidable hospitalizations (AH) within each state-year cell, a measure inspired by the AHRQ's PQIs. AH rates, generally, and the PQIs, specifically, are measures that are constructed using inpatient data, though meant to reflect the quality of care prevailing in the associated outpatient / ambulatory community. Such measures identify conditions (e.g., asthma, diabetes, malignant hypertension, etc.) with respect to which proper outpatient care would have prevented the need for hospitalization. According to the AHRQ, their PQIs grew out of research in the early 1990s by Joel Weissman and colleagues.[1] The Weissman et al. (1992) AH classification scheme is designed in slightly more general terms than the PQIs and thus arguably lends itself to easier codification using a set of NHDS records that span several decades, considering the complexity associated with tracking variations in ICD classifications over time.[2] For this reason, and in light of the fact that Weismann et al. developed their classification during the middle of the period in which the NCHS sampled physicians to compile the NHDS (unlike the PQIs, which came later), we elect to construct an AH rate for this analysis using the Weissman et al. classification.

To calculate avoidable hospitalization rates for each state and year in the sample, we first count the number of hospitalizations within the NHDS records for that state-year cell in which a diagnosis is indicated for any of the conditions included in the Weissman et al. (1992) classification. We perform such counts under two alternative approaches: one in which the conditions are identified in any one of the indicated diagnosis codes and one in which the conditions are identified in the primary diagnosis code only (the preferred approach that we take). To form the relevant rate, it is of course necessary to normalize these AH counts in some manner. Following Frakes (2013), we elect to use measures internal to the NHDS records to form the relevant denominator for each state-year AH rate, taking several alternative approaches to this normalization.[3] In one approach, for example, we normalize each AH count by the number of hospitalizations associated with the delivery of a child found in the NHDS records for the relevant state and year. This approach allows for a scaling of the AH count by a measure reflective of the size of the associated state-year sample, while also offering a denominator that is itself not likely to be significantly impacted by the prevailing malpractice environment (allowing for a focus on the influence of malpractice on the AH count comprising the numerator, our margin of interest).

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[1] See http://www.qualityindicators.ahrq.gov/Downloads/Modules/PQI/PQI%20Summary%20Report.pdf.

[2] Those conditions represented in the Weissman et al. (1992) classification include: ruptured appendix, asthma, cellulitis, congestive heart failure, diabetes, gangrene, hypokalemia, immunizable conditions, malignant hypertension, pneumonia, pyelonephritis, and perforated or bleeding ulcer.

[3] The NHDS weights are not designed to generate representative state-specific estimates. Of course, observing within-state changes over time in the set of records included in the state-year cells nonetheless affords the ability to identify the intended relationships (Dafny and Gruber 2005). In any event, though noisier, the results of this exercise generally persist under alternative approaches that either (1) multiply observations by the NHDS sample weights and form AH rates by dividing weighted AH counts by the total population of that state (yet another normalization approach), or (2) forming dependent variables based on the natural log of the state-year AH counts (i.e., under no normalization at all). The primary approaches taken, however, soften some of the sampling variability that occurs within states over time, while normalizing by a measure that is more directly reflective of the scale of the hospital sampled.

Primarily, however, based on the same premise as the delivery approach and following Frakes (2013), we normalize each state-year AH count by an index of hospitalizations equal to the count of admissions associated with any of the following conditions and events: (1) acute myocardial infarction, (2) stroke, (3) gastro-intestinal bleeding or (4) hip fracture. Such events represent situations characterized by relatively little variation across regions (see, for example, Wennberg 1984 and Wennberg and Cooper 1999), even in the face of environments that impose varying legal and financial incentives (i.e., where such hospitalizations are better seen as proxies for the underlying disease environment, as opposed to reflections of immediate healthcare utilization decisions). As such, this index likewise affords an appropriate scaling of the numerator count with arguably little concern over the malpractice environment impacting the scaling metric.[4] In yet another alternative approach, we simply normalize by the count of acute myocardial infarction discharges (primary diagnosis only) for the relevant state and year.

Low-discretionary avoidable hospitalizations. As a more refined AH rate, we focus on those subset of avoidable hospitalizations over which physicians have less discretion in admitting patients. Use of this alternative measure will ease concerns that fluctuations in the liability regime will capture changes not just in outpatient quality but in inpatient admission decisions. Following Weismann et al. (1991), Wennberg (1988) and Twigger and Jessop (2000) for guidance, we select the following conditions out of the Weissman et al. (1992) conditions as being on the lower end of the discretionary scale: ruptured appendix, pneumonia, and congestive heart failure (CHF). The resulting measure is largely dominated by CHF and pneumonia admissions. The results are virtually identical when ruptured appendix is dropped from the calculation.[5]

With these latter selection concerns in mind, the main text focuses on low-discretionary avoidable hospitalizations. We note that the findings from this more refined approach are virtually identical to the broader AH rate construction (results available upon request).

Inpatient mortality for selected conditions. Following the AHRQ's IQIs, we next construct a quality measure in which we calculate the composite rate of inpatient mortality among a sub-sample of discharges in which the primary diagnosis code indicates any one of the following conditions: acute myocardial infarction, heart failure, acute stroke, gastrointestinal bleeding, hip

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[4] See Frakes (2013) for empirical support over the contention that the incidences of these low-variation conditions are not sensitive to medical liability standards. Note that higher quality outpatient care may be effective at reducing some amount of hospitalizations for the above-indicated low-variation conditions, though likely to an extent less than quality care may reduce the incidence of the Weissman et al. (1992) avoidable conditions, in which case the proposed avoidable hospitalization rate nonetheless identifies a relative quality measure.

[5] We are aware that ruptured appendices as an avoidable hospitalization metric are often calculated with a different denominator—i.e., the number of hospitalizations for appendicitis as opposed to the full population. We find this choice awkward however, since ideally what we want to know are the population of appendicitis at the outpatient level, which may not track the number of inpatient admissions for appendicitis. After all, effective outpatient care for appendicitis will reduce the number of hospitalizations for the condition, leaving this choice of denominator seemingly endogenous. Accordingly, in including ruptured appendix in the numerator of the low-discretionary avoidable hospitalization rate, we nonetheless scale this count by the same measure we use for the rest of the avoidable hospitalization conditions (see above).

fracture or pneumonia. Such events are generally high volume in occurrence, allowing for robust sample sizes. It is worth noting that such conditions, for the most part, also represent low-discretionary hospitalizations, whereby inpatient admissions generally follow upon their occurrence.[6] With this in mind, mortality rates among this sub-sample of admissions can be seen as more likely reflective of the quality of care observed during the inpatient stay itself, rather than as a result of risk selection by providers or patients.

Of course, a concern arises regarding fluctuations in the proportions of the various conditions comprising this selected-conditions sub-sample. That is, a reduction in the composite mortality rate could arise from a relative increase in the rate of hip fracture admissions (where mortality rates are lower for such admissions relative to the other selected conditions), as opposed to reductions in mortalities that would actually be attributable to improvements in quality. We take two approaches to dealing with this concern. First, in some specifications, we include state-year controls for the proportion of this sub-sample made up of each of the respective conditions. In the primary approach, however, we follow the AHRQ and standardize the composite mortality rate for state-year changes in the various incidences of the conditions.

To risk adjust mortality rates, we employ an indirect standardization approach, in which we first predict the mortality rate that a national sample of patients would be expected to experience if they faced the relevant patient characteristics of each state-year cell. We generate such predictions based on the estimated coefficients from national, annual regressions of mortality incidence on the incidence of the relevant set of conditions. We then calculate the standardized mortality rate by (1) taking the ratio between the observed state-year composite mortality rate and this predicted national mortality rate and (2) multiplying this ratio by the observed national mortality rate.

Patient safety incidents and delivery complications. For the reasons set forth in the text, we focus our patient-safety analysis on the delivery-related PSI's inspired by the AHRQ, which represent third and fourth degree lacerations during deliveries (aggregating this analysis across vaginal and cesarean deliveries). Again following Currie and MacLeod (2008), we supplement these PSI delivery measures by forming a measure equal to the incidence of preventable delivery complications: fetal distress, excessive bleeding, precipitous labor, prolonged labor, or dysfunctional labor.

Behavioral Risk Factor Surveillance System

Our data source for the cancer-screening analysis is the Behavioral Risk Factor Surveillance System (BRFSS). The data consists of repeated cross-sections for the years 1987 through 2008, collected via monthly telephone surveys of individuals aged 18 years and older. The BRFSS is a nationally representative survey of the United States and has been conducted by state health departments in coordination with the CDC for the purpose of collecting state-level data pertaining to certain personal health behaviors. Fifteen states took part in the first survey in 1984. By 1994,

[6] For a discussion of the selection of low-discretionary hospitalization categories, see Carter (2003).

all 50 states and the District of Columbia became involved. The survey was administered to an average of 817 individuals per state in 1984, rising to an average of nearly 8000 per state in 2008.

Cancer-Screening Measures

Sigmoidoscopy / Colonoscopy. In our primary specification, we aimed to construct a proctoscopy screening measure in line with recommended screening guidelines. As such, we focused on the age group between 50 and 75 years old and created an indicator variable equal to "1" if the respondent has had a sigmoidoscopy or a colonoscopy within the last 5 years. In alternative specifications we simply indicate whether or not the respondent within this age range has ever had a sigmoidoscopy or a colonoscopy. Proctoscopic examination information within the BRFSS is available from 1988 onwards.

Mammogram. In our primary specification, we construct a mammogram screening measure in line with the recommended screening guidelines in place for most of our sample period. Accordingly, limiting our sample to those female respondents with an age between 40 and 75 year olds, we created an indicator variable reflecting whether or not the respondent received a mammogram within the last 2 years. In alternative specifications, we simply indicate whether or not the respondent within this age range has ever had a mammogram. Mammography information within the BRFSS is available from 1987 onwards.

Physical breast exam. Likewise in line with recommended guidelines, our primary specifications construct physical or clinical breast exam utilization measures by looking at the sample of at least 40 years of age and asking whether or not they have had a breast exam within the last year. In alternative specifications, we simply indicate whether or not they have ever had a physical breast exam. Physical breast exam information within the BRFSS is available from 1990 onwards.

PSA Testing. Consistent with recommendations, at least with respect to those recommendations operating over our sample period, we focus on the sample of males over the age of 50 (and under the age of 75) and construct an indicator regarding whether or not they have received Prostate-Specific Antigen (PSA) testing within the last year. In alternative specifications, we simply indicate whether or not they have ever had PSA testing. PSA testing information within the BRFSS is available from 2001 onwards.

Digital Rectal Exam. Consistent with recommendations, at least with respect to those recommendations operating over our sample period, we focus on the sample of males over the age of 50 (and under the age of 75) and construct an indicator regarding whether or not they have received a Digital Rectal Exam (DRE) within the last year. In alternative specifications, we simply indicate whether or not they have ever had a DRE. DRE information within the BRFSS is available from 1988 onwards, though not at sufficient numbers until 1993 onwards (with several years omitted in the late 1990s).

Pap smear. Consistent with recommendations, at least with respect to those recommendations operating over our sample period, we focus on the sample of females 21 years old and over and construct an indicator regarding whether or not they have received pap testing within the last year. In alternative specifications, we simply indicate whether or not they have ever had a pap smear. Pap testing information within the BRFSS is available from 1987 onwards.

Additional Notes on Non-Economic Damage Caps

Following Frakes (2012), we also classify states as having non-economic damages provisions if they have laws that place caps on total damages awards. Such laws, after all, necessarily cap non-economic damages as well. In light of the imposition of state fixed effects, this classification only has relevance in the context of 1 state (Texas) that adopted a total damages cap at a time when it did not have a specific non-economic damage cap in place. Only 1 additional state – i.e., Colorado – adopted a total damages cap over the sample period (2 years following the adoption of a non-economic damages cap). With this in mind, we do not separately control for the incidence of a cap on total damages. However, we estimate nearly identical results for the remaining coefficients when we do include this additional covariate and treat total and non-economic damage caps separately.

Additional Notes on Liability Standard Reforms

Frakes (2013) dropped Hawaii and Texas from its analysis due to difficulties in tracing the evolution of national-standard rules within those states over time. However, Frakes (2013) indicated that its results were robust to the best reading of Texas' locality-rule status over this time period—i.e., that Texas held a national-standard rule over the full sample period. In this paper, we adopt this alternative approach as the main approach and include Texas in the full specification and treat it as a control state with a constant national-standard-rule status over the sample. Including Texas in the analysis is important given its critical role in discussions surrounding damage caps and traditional reforms.

Following Frakes (2013), we exclude from this initially-high versus initially-low analysis the state of Maryland, which modified its standard of care laws over the 1990s to retreat from a previous national-standard adoption, insofar as it is difficult to hypothesize the direction in which practices will evolve subsequent to this retreat.

Other Tort Reforms

A number of specifications include the incidence of additional tort measures as covariates, including reforms of the collateral source rule and the joint and several liability rule and caps on punitive-damages awards. Traditional collateral source rules generally prohibited defendants from introducing evidence of compensatory payments made to plaintiffs from outside sources (e.g., insurers). Thirty-three states currently have laws in place that eliminate this traditional rule, effectively reducing the scope of compensatory damage awards. Much of these reforms likewise occurred during the mid-1980s; however, there are a substantial amount of independent reforms of each type, facilitating identification of their separate impacts.

Punitive damages are awarded on a much rarer basis in malpractice actions than are non-economic damages awards (without a correspondingly large increase in average payouts).[7] Thus, relative to non-economic damages, it is arguable that the threat of liability for punitive damages will have a weaker impact on physician behavior. Nonetheless, despite the infrequent application of such awards, considering that punitive damages are generally not insured by liability carriers, it remains reasonable to believe that physicians may be sensitive to the threat posed by punitive awards (Malani and Reif 2012).

Finally, we look to reforms of the common law joint and several liability rule. Under the common law approach, when there is more than one liable defendant, the plaintiff can seek full recovery against any one defendant, even if that one defendant was only responsible for a small portion of the damages. Reforms to this common law rule generally pushed in the direction of holding defendants responsible for a share of the damages proportionate with their responsibility (specified in various ways).

Other Covariates (by Quality Indicator)

Inpatient mortality rate for selected medical conditions. In the case of the mortality rates specifications, estimated according to equation (1) in the text, $\mathbf{X}_{s,t}$ represents certain demographic characteristics: the percentage of patients in various age-sex categories,[8] race categories (white, black and other), insurance categories (private, government, no insurance and other), along with the percentage of patients visiting hospitals of various bed sizes (0-100, 100-200, 200-300, 300-

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[7] For evidence of this claim, see Cohen (2005) and Hyman et al. (2009).

[8] Age-sex categories for the inpatient mortality and AH specifications are as follows: male under 30, female under 30, male 30-45, female 30-45, male 45-55, female 45-55, male 55-65, female 55-65, male 65-75, female 65-75, male over 75 and female over 75. Age-sex categories for the obstetric specifications are as follows: 15-19, 20-24, 25-29, 30-34, 35-39 and 40+ years old.

500 and 500+ beds) and of various ownership types (for-profit, non-profit and government).[9] $\mathbf{X}_{s,t}$ also includes certain other state-year characteristics (physician concentration rate).[10]

In alternative specifications, we also control for the average length of stay associated with hospitalizations for such medical conditions. To the extent that medical liability forces also impact lengths of stay for such hospitalizations, any such development could confound the estimation of liability forces on inpatient mortality rates insofar as longer hospitalizations otherwise increase the probability of an inpatient mortality. The results are virtually unchanged with such controls. Supporting this insensitivity to the inclusion of length-of-stay controls, we also find, in separate specifications (available upon request), no association between the adoption of the various reforms and the length of stay associated with hospitalizations for the selected medical conditions.

Avoidable hospitalization rates. $\mathbf{X}_{s,t}$ in the AH rate specifications are identical to those of the inpatient mortality rate specifications.

Maternal trauma rates and delivery complication rates. In the obstetrics specifications, **X** includes mother's age (15-19, 20-24, 25-29, 30-34, 35-39 and 40+ years old); mother's race (white, black and other); mother's insurance status (private, government, no insurance and other); hospital bed size (0-100, 100-200, 200-300, 300-500 and 500+ beds); and hospital ownership type (for-profit, non-profit and government). $\mathbf{X}_{s,t}$ also includes the state-year fertility rate and the state-year OB-GYN concentration rate.[11] Obstetric specifications also include controls for cesarean delivery and episiotomy utilization. The maternal trauma specifications also include a control capturing the risk-status associated with the delivery, specified following Frakes (2013) as the predicted probability of cesarean delivery (PPC). PPC values are calculated using fitted values of a logit model (estimated annually) of the incidence of cesarean delivery on a set of individual risk factors and complications. We include this measure from Frakes (2013) simply as a way to capture all such risk factors and complications in a single measure. The results are robust to including separate indicator variables for all such measures. Note that we exclude this control in the main specification of the delivery complications specification given that the outcome variable in that context is meant to capture certain of those complications itself. In alternative specifications of

[9] We form the incidences of the relevant demographic variables using the NHDS sample itself, though the results are entirely robust to alternative state-year controls based off of the Census data. Following Frakes (2013), in the AH rate and mortality rate specifications, we form the relevant incidences using the sample of discharges in which patients present themselves for acute myocardial infarction, stroke, gastro-intestinal bleeding or hip fracture. This subsample consists of patients that will almost universally seek hospitalization upon the occurrence of the event, in which case the sample itself is generally not sensitive to the prevailing legal environment. In any event, the results of this exercise are also robust to the formation of the demographic covariates using the entire sample of state-year NHDS discharges. In the obstetrics specifications, we form all relevant incidences using the subsample of discharges associated with deliveries.

[10] In certain specification checks, we control for HMO penetration rates, which are from Interstudy Publications. Data on physician population counts are from the American Medical Association (AMA) administrative records and were obtained from the Area Resource File.

[11] Fertility rates are calculated according to Gruber and Owings (1996) as the number of births per population and come from the Vital Statistics Natality files (also obtained via the ARF).

the delivery complications approach, we also include controls for all non-preventable complications and risk factors. The results are virtually identical under such alternative specifications (available upon request).

Cancer Screening Rates. **X** in the cancer screening specifications includes various individual characteristics provided for in the BRFSS files: marital status (married, widowed, divorced, single), race (white, black, and other), educational attainment category, Hispanic origin, income (and its square), age category (by age deciles), and smoking status. **X** also includes certain characteristics of the prevailing state-year health care market (including physician concentration rate and the average number of hospital beds per capita),[12] along with HMO penetration rates and its square.

State-Specific Linear Pre-Treatment Time Trends

In some specifics, we take an alternative approach to the fitting of state-specific linear trends in which we instead fit state-specific linear pre-treatment time trends. That is, we interact a state-specific linear time trend with an indicator variable equal to 1 in the pre-reform period for treatment states and 0 otherwise. The fitted trend variable works backwards from the time of adoption in the relevant state such that it equals 0 at the time of adoption. The results are robust to alternatively fitting a single pre-treatment trend variable (e.g., a variable equal to 0 for all control states, 0 in the post-adoption period for all treatment states, 1 in the year prior to adoption in the treatment states, 2 in the second year prior to adoption in the treatment states, and so on and so forth). This approach is also robust to fitting a linear time trend for each control state (rather than setting this trend variable equal to 0).

[12] Average hospital bed data was likewise obtained from the ARF.

Online Appendix B: Additional Robustness Checks

Dynamic Difference-in-Difference Results

In the following tables, we extend the analysis in the text to include difference in difference regression results that include a number of leads and lags of the key legal reforms—damages caps and national-standard reforms.

Note that we specify the 4-year lead coefficient as turning from zero to one 4 years prior to the national-standard-law adoption in the relevant state and staying at 1 thereafter. The other lead and lag variables are specified accordingly. With this specification, the coefficient of the 4-year lead coefficient captures the differential in the relevant rate between treatment and control states in the period of time between the three- and four-year period prior to a national-standard adoption and the years prior to that period. The coefficient of the 3-year lead variable then captures the *subsequent* change in this differential as we move into the next year-long period—i.e., the differential quality rate between treatment and control states in the 2-3-year-prior period relative to the 3-to-4-year-prior period. And so on and so forth. To capture the cumulative time trend in the differential quality rate between treatment and control states—with time entailing years prior to and subsequent to national-standard adoptions—one naturally adds up these subsequent coefficient levels. The figures presented in the text take this cumulative approach.

Table B1. Initially Low-Quality States: Relationship between National Standard Laws and the AHRQ-Inspired Quality Metrics, Dynamic Difference-in-Difference Regression Results across Various Specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Non-Obstetric Quality Metrics								
	INPATIENT MORTALITY RATE FOR SELECTED MEDICAL CONDITIONS (LOGGED)				LOW-DISCRETIONARY AVOIDABLE HOSPITALIZATION RATES (LOGGED)			
National-Standard Law Dummy								
4-Year Lead Dummy	0.048	-0.009	-0.085	-0.079	0.012	-0.018	-0.046	0.058
	(0.084)	(0.070)	(0.121)	(0.142)	(0.052)	(0.146)	(0.154)	(0.130)
3-Year Lead Dummy	-0.143	-0.122	-0.142	-0.145	0.095	0.091	0.140	0.108
	(0.125)	(0.093)	(0.089)	(0.107)	(0.136)	(0.177)	(0.169)	(0.195)
2-Year Lead Dummy	0.039	0.092	0.069	0.071	0.010	0.008	-0.020	-0.017
	(0.076)	(0.090)	(0.100)	(0.100)	(0.080)	(0.082)	(0.088)	(0.102)
1-Year Lead Dummy	0.098	0.113	0.110	0.090	-0.108	-0.052	-0.077	-0.095
	(0.122)	(0.142)	(0.151)	(0.141)	(0.075)	(0.071)	(0.088)	(0.125)
Contemporaneous Dummy	-0.091	-0.118	-0.139*	-0.140*	0.012	-0.024	-0.049	-0.074
	(0.065)	(0.073)	(0.069)	(0.072)	(0.051)	(0.106)	(0.111)	(0.145)
1-Year Lag Dummy	-0.058	-0.020	-0.037	-0.023	-0.219*	-0.237*	-0.273*	-0.231
	(0.072)	(0.080)	(0.082)	(0.087)	(0.116)	(0.139)	(0.137)	(0.143)
2-Year Lag Dummy	0.029	-0.026	-0.065	-0.022	-0.020	-0.020	-0.016	-0.031
	(0.080)	(0.103)	(0.119)	(0.103)	(0.067)	(0.071)	(0.066)	(0.073)
3-Year Lag Dummy	0.106	0.129	0.142	0.130	-0.136*	-0.081	-0.075	-0.082
	(0.106)	(0.163)	(0.148)	(0.163)	(0.072)	(0.092)	(0.088)	(0.093)
4-Year Lag Dummy	-0.124*	-0.128	-0.207*	-0.129	-0.137	-0.180	-0.256*	-0.168
	(0.064)	(0.088)	(0.107)	(0.090)	(0.124)	(0.117)	(0134)	(0.110)
Panel B. Obstetric Quality Metrics								
	MATERNAL TRAUMA RATES (LOGGED)				PREVENTABLE DELIVERY COMPLICATION RATES (LOGGED)			
National-Standard Law Dummy								
4-Year Lead Dummy	0.081	0.209	0.296	0.416**	0.174	0.147	-0.012	0.208
	(0.087)	(0.168)	(0.245)	(0.191)	(0.170)	(0.241)	(0.145)	(0.127)
3-Year Lead Dummy	-0.139	-0.163	-0.192	-0.433	-0.120	-0.002	0.038	-0.062
	(0.304)	(0.232)	(0.252)	(0.256)	(0.108)	(0.097)	(0.101)	(0.118)
2-Year Lead Dummy	0.107	0.202	0.134	0.147	-0.179*	-0.128*	-0.127*	-0.164
	(0.226)	(0.238)	(0.259)	(0.181)	(0.091)	(0.065)	(0.065)	(0.123)
1-Year Lead Dummy	0.251***	0.224**	0.226***	0.166	0.059	0.087	0.071	0.036
	(0.066)	(0.090)	(0.078)	(0.135)	(0.129)	(0.140)	(0.158)	(0.150)
Contemporaneous Dummy	-0.433**	-0.464*	-0.482*	-0.503**	-0.382***	-0.485***	-0.498***	-0.541***
	(0.184)	(0.236)	(0.262)	(0.213)	(0.114)	(0.151)	(0.143)	(0.137)
1-Year Lag Dummy	0.123	0.006	0.029	-0.004	0.213	0.304**	0.336**	0.296**

	(0.297)	(0.330)	(0.331)	(0.332)	(0.126)	(0.127)	(0.134)	(0.128)
2-Year Lag Dummy	0.182	0.166	0.124	0.188	-0.096	-0.150	-0.171	-0.167
	(0.156)	(0.151)	(0.162)	(0.145)	(0.110)	(0.114)	(0.108)	(0.109)
3-Year Lag Dummy	-0.231	-0.111	-0.127	-0.112	0.064	0.153	0.151	0.162
	(0.175)	(0.161)	(0.153)	(0.162)	(0.135)	(0.164)	(0.181)	(0.162)
4-Year Lag Dummy	-0.074	0.090	-0.031	0.101	0.036	-0.095	-0.054	-0.076
	(0.219)	(0.173)	(0.151)	(0.171)	(0.134)	(0.152)	(0.162)	(0.149)
State-Year Covariates?	NO	YES	YES	YES	NO	YES	YES	YES
State-Specific Linear Time Trends?	NO	NO	YES	NO	NO	NO	YES	NO
State-Specific Linear Pre-treatment Time Trends?	NO	NO	NO	YES	NO	NO	NO	YES

Notes: robust standard errors corrected for within-state correlation in the error term are reported in parentheses. Specifications are weighted per their counterparts in Table 3 of the text.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table B2. Initially High-Quality States: Relationship between National Standard Laws and the AHRQ-Inspired Quality Indicators, Dynamic Difference-in-Difference Regression Results

	(1)	(2)	(3)	(4)
	INPATIENT MORTALITY RATE (LOGGED)	LOW-DISCRETION AH RATE (LOGGED)	MATERNAL TRAUMA RATE (LOGGED)	PREVENTABLE DELIVERY COMPLICATIONS (LOGGED)
National Standard Law Dummy				
4-Year Lead Dummy	-0.229*	-0.065	0.360	-0.015
	(0.114)	(0.052)	(0.239)	(0.117)
3-Year Lead Dummy	0.124	-0.156	-0.391	-0.285
	(0.158)	(0.135)	(0.271)	(0.190)
2-Year Lead Dummy	0.295	0.104	-0.076	0.030
	(0.282)	(0.070)	(0.142)	(0.097)
1-Year Lead Dummy	-0.065	-0.091	0.342	0.018
	(0.162)	(0.084)	(0.251)	(0.185)
Contemporaneous Dummy	0.139	-0.011	-0.334**	-0.052
	(0.266)	(0.099)	(0.125)	(0.262)
1-Year Lag Dummy	-0.210	-0.013	0.147	-0.004
	(0.196)	(0.101)	(0.228)	(0.171)
2-Year Lag Dummy	0.176	0.064	-0.120	0.064
	(0.249)	(0.032)	(0.117)	(0.161)
3-Year Lag Dummy	0.028	-0.095**	0.289	-0.069
	(0.125)	(0.040)	(0.240)	(0.085)
4-Year Lag Dummy	0.017	0.006	0.149	0.109
	(0.120)	(0.041)	(0.249)	(0.135)

Notes: robust standard errors corrected for within-state correlation in the error term are reported in parentheses. Each specification controls for state fixed effects, year fixed effects, various covariates and a set of state specific linear time trends. Specifications are weighted per their counterparts in Table 3 of the text.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Table B3. Relationship between Damage Caps and the AHRQ-Inspired Quality Indicators: Dynamic Difference-in-Difference Regression Results

	(1)	(3)	(4)	(5)
	INPATIENT MORTALITY RATE (LOGGED)	LOW-DISCRETION AH RATE (LOGGED)	MATERNAL TRAUMA RATE (LOGGED)	PREVENTABLE DELIVERY COMPLICATIONS (LOGGED)
Non-Economic Damage Cap				
4-Year Lead Dummy	-0.083***	0.044	0.074	-0.046
	(0.028)	(0.024)	(0.045)	(0.053)
3-Year Lead Dummy	-0.012	-0.026	-0.104**	0.053
	(0.037)	(0.021)	(0.041)	(0.039)
2-Year Lead Dummy	-0.010	-0.006	0.015	0.022
	(0.057)	(0.031)	(0.065)	(0.042)
1-Year Lead Dummy	0.029	-0.001	0.013	-0.051
	(0.042)	(0.023)	(0.061)	(0.050)
Contemporaneous Dummy	-0.051	-0.011	-0.037	0.013
	(0.046)	(0.028)	(0.067)	(0.042)
1-Year Lag Dummy	0.030	-0.011	-0.054	-0.002
	(0.066)	(0.023)	(0.077)	(0.038)
2-Year Lag Dummy	0.037	-0.055**	0.049	0.000
	(0.068)	(0.027)	(0.092)	(0.076)
3-Year Lag Dummy	0.031	0.030	0.007	-0.010
	(0.053)	(0.029)	(0.091)	(0.054)
4-Year Lag Dummy	-0.041	-0.004	0.013	0.005
	(0.050)	(0.021)	(0.064)	(0.041)

Notes: robust standard errors corrected for within-state correlation in the error term are reported in parentheses. Each specification controls for state fixed effects, year fixed effects, various covariates and a set of state specific linear time trends. Specifications are weighted per their counterparts in Table 4 of the text and otherwise track the specifications in such tables. Dependent variables are logged.

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table B4. Relationship between Damage Caps and Cancer Screening Rates: Dynamic Difference-in-Difference Regression Results

	(1) MAMMO-GRAM	(2) PHYSICAL BREAST EXAM	(3) PROCTO-SCOPIC EXAM	(4) PSA TESTING	(5) DIGITAL RECTAL EXAM	(6) PAP SMEAR
Non-Economic Damage Cap						
4-Year Lead Dummy	-0.009	-0.006	-0.019***	0.013	0.007	-0.003
	(0.006)	(0.006)	(0.007)	(0.015)	(0.017)	(0.006)
3-Year Lead Dummy	0.007	0.010	-0.004	-0.023	-0.009	0.015*
	(0.004)	(0.008)	(0.007)	(0.016)	(0.015)	(0.007)
2-Year Lead Dummy	0.005	-0.001	-0.002	0.022*	0.018	-0.002
	(0.006)	(0.008)	(0.007)	(0.011)	(0.012)	(0.007)
1-Year Lead Dummy	0.017**	0.032***	-0.001	0.024***	-0.006	0.025***
	(0.007)	(0.007)	(0.011)	(0.009)	(0.014)	(0.006)
Contemporaneous Dummy	-0.023***	-0.019**	-0.022	0.017	0.027	-0.018***
	(0.006)	(0.008)	(0.014)	(0.014)	(0.018)	(0.007)
1-Year Lag Dummy	0.019**	0.021	0.018	-0.008	-0.043**	0.021**
	(0.007)	(0.011)	(0.010)	(0.010)	(0.018)	(0.010)
2-Year Lag Dummy	0.000	0.001	-0.007	0.043**	0.032	-0.004
	(0.006)	(0.009)	(0.009)	(0.019)	(0.018)	(0.010)
3-Year Lag Dummy	0.002	-0.000	0.013	0.003	-0.017	0.014
	(0.008)	(0.009)	(0.009)	(0.017)	(0.015)	(0.012)
4-Year Lag Dummy	0.002	0.001	-0.009	0.022**	-0.009	0.005
	(0.006)	(0.007)	(0.008)	(0.010)	(0.012)	(0.006)

Notes: robust standard errors corrected for within-state correlation in the error term are reported in parentheses. Each specification controls for state fixed effects, year fixed effects, various covariates and a set of state specific linear time trends.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table B5. Alternative Interaction Specification: the Relationship between National-Standard Laws and Various Health Care Quality Metrics, Interacting Low-Quality Indicator with National-Standard Rule Indicator

	(1)	(2)	(3)	(4)
Panel A. Dependent Variable: Inpatient Mortality Rate for Selected Conditions (Logged)				
National-Standard (NS) Law Dummy	0.052**	0.093*	0.130*	0.038
	(0.023)	(0.047)	(0.066)	(0.036)
NS Law * Initially Low Quality State	-0.133*	-0.174**	-0.234*	-0.134*
	(0.071)	(0.063)	(0.131)	(0.073)
Panel B. Dependent Variable: Low-Discretionary Avoidable Hospitalization Rate (Logged)				
National-Standard (NS) Law Dummy	-0.009	-0.013	-0.039	-0.080
	(0.037)	(0.028)	(0.033)	(0.051)
NS Law * Initially Low Quality State	-0.528***	-0.456***	-0.297***	-0.475***
	(0.125)	(0.109)	(0.079)	(0.139)
Panel C. Dependent Variable: Maternal Trauma Rate (Logged)				
National-Standard (NS) Law Dummy	0.050	-0.074	0.093	-0.015
	(0.073)	(0.106)	(0.113)	(0.073)
NS Law * Initially Low Quality State	-0.446**	-0.247	-0.390	-0.285*
	(0.178)	(0.211)	(0.316)	(0.169)
Panel D. Dependent Variable: Preventable Delivery Complication Rate (Logged)				
National-Standard (NS) Law Dummy	0.110	0.021	0.053	-0.017
	(0.071)	(0.030)	(0.060)	(-0.010)
NS Law * Initially Low Quality State	-0.513***	-0.422***	-0.486**	-0.262
	(0.135)	(0.124)	(0.187)	(0.176)
Control Variables?	NO	YES	YES	YES
State-Specific Linear Trends?	NO	NO	YES	NO
State-Specific Pre-Treatment Linear Trends?	NO	NO	NO	YES

Notes: robust standard errors corrected for within-state correlation in the error term are reported in parentheses. All regressions include state and year fixed effects. Regressions in Panel A are weighted by the number of admissions (for the relevant state and year) in the sub-sample of discharges associated with the relevant selected conditions (e.g., acute myocardial infarction). Regressions in Panel B are weighted by the low-variation health index (i.e., the sum of discharges for acute myocardial infarction, stroke, hip fracture or gastrointestinal bleeding) associated with each state-year cell. Regressions in Panels C and D are weighted by the number of deliveries associated with the relevant state-year cell. Inpatient mortality rates are risk-adjusted for the incidence (among the sub-sample) of each of the conditions comprising the sub-sample of selected conditions.

Source: 1979 – 2005 National Hospital Discharge Surveys.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Additional Specification Checks

Construction of Avoidable Hospitalization Rates. The results presented in the text are robust to alternative constructions of the AH Rates, including those constructions that (1) flag avoidable hospitalizations using any diagnosis field, not just the primary diagnosis field, (2) normalize avoidable hospitalization counts by the number of deliveries of children in the associated state-year cell (an alternative measure of the size of the cell that is not itself subject to influence by the prevailing liability environment), (3) normalize avoidable hospitalization counts by the number of acute myocardial infarctions in the associated state-year cell (rather than the low-variations health index that likewise includes strokes, hip fractures and gastro-intestinal bleedings), (4) use non-logged AH rates as the dependent variable and (5) focus only on the adult (18-plus) population. These results are available upon request from the authors.

Construction of Inpatient Mortality Rate for Selected Medical Conditions. The results presented in the text are robust to alternative constructions of the inpatient mortality rate for selected medical conditions, including those constructions that (1) specify the outcome variable as the incidence of mortality out of an individual sample of admissions for the selected medical conditions (as distinct from the primary specification whose unit of observation is a given state-year cell), (2) use mortality rates as the dependent variable that are not risk adjusted for fluctuations in the state-year incidence of the underlying medical conditions, but instead include as covariates the incidence of such conditions, and (3) focus the analysis only on the adult population. These results are available upon request from the authors.

Note that the unit of observation in the inpatient mortality rate specification estimated in the text is a given state-year cell. In an alternative approach (not shown), we estimate linear probability models where the unit of observation is an individual discharge within the sample of inpatient admissions associated with the selected conditions (e.g., acute myocardial infarctions, strokes, etc.) and where the dependent variable is an indicator for inpatient mortality (in such models, we include controls for the incidence of the relevant conditions). The results from this alternative approach are (perhaps not surprisingly) nearly identical to those of the state-year specifications estimated in the text. In alternative specifications, we likewise take an individual discharge approach for the obstetrics analysis and derive essentially identical results.

Cancer Screening / Damage-Cap Results. The cancer screening results presented in Table 5 of the text are robust to a number of alternative formulations of the relevant cancer screening measures, including alternative formulations of the age restrictions (e.g., those 40 – 75 years old in the case of proctoscopic examination, instead of 50 – 75) and alternative framing of the frequency of the screening—that is, using all of the frequency formulations provided by the BRFSS (e.g., annual, every 2 years, every 5 years, etc.). In the interests of brevity, we do not present the full extent of these alternative formulations, though they are available upon request from the authors. We do, however, present in the following table results (analogous to those from Table 5 in the text) using the incidence of ever having had the relevant screening test as the operable dependent variable.

Table B6. Relationship between Remedy-Centric Tort Reforms and Cancer Screening Rates. Alternative Formulation: Incidence of Ever Having the Indicated Screening

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	MAMMOGRAM	PHYSICAL BREAST EXAM	PROCTOSCOPIC EXAM	PSA TESTING	DIGITAL RECTAL EXAM	PAP SMEAR
Non-Economic Damage Cap	0.008* (0.005)	-0.000 (0.003)	-0.004 (0.007)	-0.004 (0.005)	0.008 (0.008)	-0.002 (0.002)
95% Confidence Band for Coefficient of Non-Economic Damage Cap Variable	[-0.001, 0.019]	[-0.006, 0.006]	[-0.018, 0.010]	[-0.015, 0.007]	[-0.009, 0.025]	[-0.007, 0.002]
95% Confidence Band, scaled by mean screening rate	[-0.001, 0.026]	[-0.010, 0.010]	[-0.045, 0.025]	[-0.028, 0.013]	[-0.018, 0.050]	[-0.011, 0.004]
N	1010415	1156433	849445	252313	341102	1664055

Notes: robust standard errors corrected for within-state correlation in the error term are reported in parentheses. All regressions included state and year fixed effects.
Source: 1987 – 2008 Behavioral Risk Factor Surveillance System Records.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table 5 in the text presents results from the basic difference-in-difference specification without the various control variables included. Table B4 above, which includes a full set of leads and lags of the damage-cap variable, presents results from specifications that include a range of covariates (as set forth in Online Appendix B above) along with a set of state-specific linear time trends.

Randomization Inference. Following Frakes (2013), we also endeavored to take an alternative route towards estimating the standard errors associated with our estimates. Though less powerful, this approach nonetheless facilitates inferences in situations with a limited number of treatment groups in the face of a possibly non-normal error distribution. Using the sample of observations from our control states, we simulate a set of placebo laws that match the distribution of timing of actual reforms. We then estimate the association between the relevant quality indicator and the placebo laws, replicating this process 5,000 times. We then observe where the actual coefficient from our primary specifications—focusing on the coefficient of the national-standard dummy—falls in the distribution of coefficients generated through these simulations. To the extent the actual estimates remain an outlier on this placebo-treatment distribution, one may be more confident in the statistical significance of the findings. We present results of this exercise in Table B7. Despite the lesser power of this flexible approach to inference, we continue to find that the improvements in quality following national-standard reforms in initially low quality states are statistically significant in the case of the avoidable hospitalization, maternal trauma and delivery complication specifications. With respect to the inpatient mortality results, this approach does not suggest statistical significance at the conventional levels, though nonetheless falls near the bottom end of the placebo-effects distribution.

Table B7. Randomization Inference on Point Estimates from Columns 2 and 3 of Table 2

	(1)	(2)	(3)	(4)
	Actual Coefficient Estimate		Percentile of Placebo-Treatment-Effects Distribution where actual effects fall	
Inpatient Mortality Rate for Selected Medical Conditions	-0.081	-0.104	Bottom 18 percent	Bottom 7 Percent
Low-Discretionary Avoidable Hospitalization Rate	-0.469	-0.336	bottom 1/10 percent	Bottom 2 percent
Maternal Trauma Rate	-0.321	-0.297	Bottom 5 percent	Bottom 2 percent
Preventable Delivery Complication Rate	-0.401	-0.433	bottom 1 Percent	Bottom 2 percent
State-Specific Linear Time Trends?	NO	YES	NO	YES

Tort-Law Generally Damage Caps

Damage-cap adoptions in many states applied to tort cases broadly, not simply those pertaining to medical malpractice. Damage-cap adoptions in other states applied only to medical malpractice situations. General tort-law caps are arguably likely to pose fewer legislative endogeneity concerns. As such, in other specifications, we replicate the damage-cap analysis by codifying caps using only those adoptions that apply to tort laws more broadly, dropping those states from the analysis that adopted caps in malpractice-specific contexts. If anything, the results of this alternative analysis suggest an even more modest decrease in health care quality connected with damage cap adoptions. For instance, in the case of avoidable hospitalization rates, the coefficient of this modified damage-cap variable is -0.03, with a 95 percent confidence interval of [-0.08,0.02]. In the case of inpatient mortality rates for selected medical conditions, the coefficient is -0.04, with a 95 percent confidence interval of [-0.11, 0.04]. The full set of results for this alternative approach are available upon request.

Cancer Screening Liability Standards Analysis.

As stated in the text, data is available for cancer screening rates over a period of time in which only 3 states modified their standard of care rules: Delaware, Indiana, and Rhode Island. Moreover, only with respect to mammography and pap testing is data available over the full BRFSS period, facilitating any ability to draw upon the experiences of these three treatment states and to properly test for pre-period trends. A further difficulty comes with the fact that even fewer treatment states are available to test the main hypothesis of interest—i.e., that quality will rise in connection with national standard adoptions among those states that begin the sample period with initially low-levels of quality. With respect to mammography, only Indiana is available as a treatment state by which to test this hypothesis. With respect to pap testing, both Indiana and Rhode Island are available for such purposes. While the results of this exercise are arguably unreliable with such few treatment states, we nonetheless present results estimating the relationship between national standard adoptions and the incidence of mammogram screening and pap testing in those states that began with lower than average screening rates and thus with respect to which national standard adoptions arguably represent a heightening of expectations.[13] In Table B8, we demonstrate how these findings are impacted by (1) the inclusion of the relevant set of covariates discussed in Online Appendix A, (2) the inclusion of state-specific linear time trends and (3) the inclusion of a set of leads and lags of the national standard variable. Note that the analysis below only includes 3 lead periods considering that there are not enough years between

[13] We focus here on estimating the impact of heightened liability standards as opposed to diminished standards. Estimation of this latter type of variation in the law is also compromised by such few treatment groups. Nonetheless, results of this alternative exercise are available upon request. If anything, the results actually suggest that screening rates also increase slightly upon national standard adoptions in those 1-2 states that adopt such reforms when they arguably entail a slackening of standards.

the beginning of the sample and Indiana's essential reform to facilitate the estimation of a 4-year lead period.

The findings weakly demonstrate that when liability standards change so as to arguably require a heightening of standards, cancer screening rates increase. In the case of mammography screening, rates generally increase subsequent to the reform, strongest with a long lag (and strongest in those specifications with state-specific linear time trends). However, mammography screening also spiked strongly with a 2-year lead creating some concerns that the increase in quality may reflect a trend that pre-dated the reform. Of course, the 1-year lead coefficient does not support any such trend. Pap testing likewise suggests an increase in screening rates with a long lag, while also raising a concern of a pre-period trend, with a strong increase in rates occurring in the year prior to the reform. While this may in part be a reflection of an anticipation effect (Malani and Reif 2012), it may also be reflective of some external factor that correlates (perhaps spuriously) with the increase in screening and with the adoption of the liability reform.

TABLE B8: The Relationship between National-Standard Laws and the Incidence of Cancer Screening in Initially Low-Screening States

	(1)	(2)	(3)	(4)	(5)	(6)
		MAMMOGRAM SCREENING			PAPSMEAR SCREENING	
National Standard Law						
3-Year Lead Dummy	-	0.012**	0.014*	-	0.038	0.010
		(0.005)	(0.007)		(0.029)	(0.012)
2-Year Lead Dummy	-	0.046***	0.048***	-	-0.017	-0.014
		(0.005)	(0.006)		(0.014)	(0.015)
1-Year Lead Dummy	-	-0.020*	-0.000	-	0.029*	0.023*
		(0.011)	(0.009)		(0.015)	(0.012)
Contemporaneous	0.040***	0.014	-0.001	0.045	-0.007	0.005
Dummy	(0.006)	(0.010)	(0.009)	(0.033)	(0.020)	(0.027)
1-Year Lag Dummy	-	-0.003	0.025**	-	-0.003	0.013
		(0.023)	(0.12)		(0.013)	(0.013)
2-Year Lag Dummy	-	0.019	0.006	-	-0.014	-0.009
		(0.018)	(0.014)		(0.011)	(0.012)
3-Year Lag Dummy	-	-0.036*	-0.030	-	0.004	-0.002
		(0.021)	(0.023)		(0.020)	(0.021)
4-Year Lag Dummy	-	0.030***	0.025**	-	0.022*	0.018
		(0.007)	(0.012)		(0.011)	(0.014)
N	631592	520955	520955	1098595	912364	912364
Control Variables?	NO	YES	YES	NO	YES	YES
State-Specific Linear Trends?	NO	NO	YES	NO	NO	YES

Notes: robust standard errors corrected for within-state correlation in the error term are reported in parentheses. All regressions include state and year fixed effects. The regressions also include a separate dummy variable indicating whether the state has an initially below-average cancer screen rate (coefficient omitted). Cancer screening data is from the BRFSS.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Damage-cap Codification

In Table B9, we estimate specifications that take an alternative approach to the codification of the damage-cap incidence variable. While the malpractice literature customarily codifies damage-cap adoptions in a simple binary fashion (0/1), non-economic damage cap provisions, in fact, take on a range of forms across jurisdictions. For instance, California imposes a flat, nominal $250,000 cap on non-economic damages awards, while Wisconsin imposes a $750,000 cap. One might imagine that California's cap would entail a stronger reduction in liability pressure. Hyman et al. (2009) use closed-claims data from Texas during the period of time prior to the imposition of its non-economic damage cap (with information on the breakdown of economic versus non-economic damages associated with the claim) to simulate the potential impact of the various damage-cap provisions across the various states. More specifically, they simulate the percentage of a mean verdict that is reduced through the imposition of the various caps employed across states.

In the present analysis, we build on these preliminary efforts by Hyman et al. (2009) and use the results of this simulation exercise as the relevant damage-cap variable within the difference-in-difference specification, as opposed to the simple binary approach. In applying these simulated measures to each state-year cell, we appropriately adjust this simulated reduction to account for inflation in the case of those damage-cap provisions that do not tie their cap levels to inflation. Inspired by studies in public finance (Currie and Gruber 1996), this codification scheme provides an empirically-informed way to ensure the comparability of the legal modifications under investigation, effectively reframing the treatment of the law in terms of the common function provided by such laws (i.e., reducing awards), as opposed to some coarse measure of their existence.

The estimated mean coefficients from those specifications using this alternative codification of damage-cap variables do not differ substantially from those derived from the traditional binary approach. In the case of inpatient mortality rates for selected medical conditions, low-discretionary AH rates, maternal trauma rates and preventable delivery complication rates, such estimates suggest a 0.1, -7.0, -13.3, and -5.1 percent change in the respective quality indicator upon an increase from 0 percent to 100% in the simulated extent to which a damage cap reduces a jury verdict. These largely negative point estimates are also inconsistent with the expectation that reducing liability pressure through the imposition of a cap will lead to a decline in quality—i.e., an increase in these respective measures. As above, of course, these results are statistically insignificant and cannot rule out some degree of a positive association between these measures and the reduction in damage awards resulting from caps. The associated upper ends of the confidence intervals for these estimates suggest a 18.3, 2.6, 16.4, and 14.9 percent change respectively. While the upper bounds are larger than those for the traditional codification approach discussed above, bear in mind that these estimates are to be interpreted in terms of a shift in the law that leads to a full 100% reduction in malpractice verdicts.

Table B9: Relationship between Simulated Damage Cap Variable and Various Health Care Quality Metrics

	(1)	*(2)*	*(3)*	*(4)*
	INPATIENT MORTALITY RATE	LOW-DISCRETIONARY AVOIDABLE HOSPITAL-IZATION RATE	MATERNAL TRAUMA RATE	PREVENTABLE DELIVERY COMPLICATION RATE
Damage Cap Strength: Simulated Percentage Decline in Mean Verdict	0.001 (0.090)	-0.070 (0.047)	-0.133 (0.148)	-0.051 (0.099)
Collateral Source Rule Reform	0.002 (0.039)	-0.012 (0.028)	-0.043 (0.083)	-0.019 (0.059)
Punitive Damage Cap	0.056 (0.044)	-0.003 (0.027)	-0.103* (0.060)	-0.017 (0.058)
Joint and Several Liability Reform	-0.008 (0.042)	0.005 (0.043)	0.167 (0.100)	0.027 (0.062)
95% Confidence Band for Coefficient of Non-Economic Damage Cap Variable	[-0.180, [0.183]	[-0.166, 0.026]	[-0.430, 0.164]	[-0.251, 0.149]
F-Statistic (Malpractice Variables Jointly = 0)	0.04	0.66	1.46	0.15
Prob > F (p value)	0.99	0.620	0.23	0.96
N	1141	1177	1053	1083

Notes: robust standard errors corrected for within-state correlation in the error term are reported in parentheses. The regression in Column 1 is weighted by the number of admissions (for the relevant state and year) in the sub-sample of discharges associated with the relevant selected conditions (e.g., acute myocardial infarction). The regression in Column 2 is weighted by the low-variation health index (i.e., the sum of discharges for acute myocardial infarction, stroke, hip fracture or gastrointestinal bleeding) associated with each state-year cell. Mortality rates are risk-adjusted for the incidence (among the sub-sample) of each of the conditions comprising the sub-sample of selected conditions.

All regressions included state and year fixed effects, along with the relevant set of state-year controls and state-specific linear time trends.

Source: 1979 – 2005 National Hospital Discharge Surveys.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Table B10: Mean Reversion Analysis: Estimated Time Trends in Quality Levels Separately for Initially Low and Initially High Quality States

	(1)	(2)	(3)	(4)
	INITIALLY LOW QUALITY STATES		INITIALLY HIGH QUALITY STATES	
	LOGS	LEVELS	LOGS	LEVELS
Panel A: Inpatient Mortality Rate for Selected Conditions				
Omitted: First 5 Sample Years	-		-	
Sample Years 5-10	-0.115*	-0.015***	-0.018	-0.007
	(0.054)	(0.005)	(0.042)	(0.004)
Sample Years 10-15	-0.178***	-0.021***	-0.103	-0.017*
	(0.053)	(0.005)	(0.088)	(0.008)
Sample Years 15-20	-0.290***	-0.029***	-0.154	-0.019*
	(0.073)	(0.007)	(0.120)	(0.011)
Sample Years 20-25	-0.371***	-0.032***	-0.258*	-0.025**
	(0.071)	(0.008)	(0.123)	(0.012)
Panel B: Low-Discretionary Avoidable Hospitalization Rate				
Omitted: First 5 Sample Years	-		-	
Sample Years 5-10	0.041	0.062	0.061*	0.108***
	(0.052)	(0.052)	(0.035)	(0.023)
Sample Years 10-15	0.149**	0.180***	0.207***	0.325***
	(0.055)	(0.054)	(0.043)	(0.020)
Sample Years 15-20	0.182*	0.223***	0.192***	0.390***
	(0.103)	(0.107)	(0.050)	(0.026)
Sample Years 20-25	0.225*	0.278***	0.203***	0.451***
	(0.10)	(0.114)	(0.066)	(0.026)
Panel C: Maternal Trauma Rate				
Omitted: First 5 Sample Years	-		-	
Sample Years 5-10	0.182*	0.006	0.473***	0.020***
	(0.092)	(0.005)	(0.078)	(0.003)
Sample Years 10-15	0.274**	0.007	0.458***	0.016***
	(0.113)	(0.006)	(0.127)	(0.006)
Sample Years 15-20	0.025	-0.004	0.382***	0.011**
	(0.093)	(0.004)	(0.131)	(0.006)
Sample Years 20-25	-0.217	-0.013*	0.120	0.002
	(0.136)	(0.007)	(0.298)	(0.006)
Panel D: Preventable Delivery Complications				
Omitted: First 5 Sample Years	-		-	
Sample Years 5-10	0.362***	0.028**	0.435***	0.032***
	(0.106)	(0.011)	(0.086)	(0.009)
Sample Years 10-15	0.575***	0.061***	0.832***	0.083***
	(0.125)	(0.014)	(0.086)	(0.008)
Sample Years 15-20	0.649***	0.081***	0.899***	0.100***
	(0.142)	(0.018)	(0.104	(0.010)
Sample Years 20-25	0.643***	0.094***	0.814***	0.095***
	(0.948)	(0.020)	(0.110)	(0.013)

Notes: robust standard errors corrected for within-state correlation in the error term are reported in parentheses. Estimated time trends are from coefficients of year-group dummy variables in regressions of the indicated dependent variable on said dummies, along with state fixed effects and various state-year demographic controls and other covariates. Regressions in Panel A are weighted by the number of admissions (for the relevant state and year) in the sub-sample of discharges associated with the relevant selected conditions (e.g., acute myocardial infarction). Regressions in Panel B are weighted by the low-variation health index (i.e., the sum of discharges for acute myocardial infarction, stroke, hip fracture or gastrointestinal bleeding) associated with each state-year cell. Regressions in Panels C and D are weighted by the number of deliveries associated with the relevant state-year cell. Inpatient mortality rates are risk-adjusted for the incidence (among the sub-sample) of each of the conditions comprising the sub-sample of selected conditions.
Source: 1979 – 2005 National Hospital Discharge Surveys.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table B11. The Relationship between National-Standard Laws and Various Health Care Quality Metrics: Additional Robustness Checks

	(1)	(2)	(3)
	EXCLUDING PHYSICIAN CONCENTRATION RATE AND HMO PENETRATION RATE	EXCLUDING HMO PENETRATION RATE	ALL COVARIATES
Panel A: Dependent Variable: Inpatient Mortality Rate for Selected Medical Conditions			
National-Standard (NS) Law	-0.079**	-0.081**	-0.074**
Dummy	(0.038)	(0.036)	(0.036)
NS Law * Initially High	0.158**	0.174**	0.176***
Quality State	(0.062)	(0.063)	(0.061)
N	1074	1074	1054
Panel B: Dependent Variable: Low-Discretionary Avoidable Hospitalization Rate			
National-Standard (NS) Law	-0.470***	-0.469***	-0.460***
Dummy	(0.064)	(0.065)	(0.062)
NS Law * Initially High	0.457***	0.456***	0.451***
Quality State	(0.110)	(0.109)	(0.098)
N	1108	1108	1088
Panel C: Dependent Variable: Maternal Trauma Rate			
National-Standard (NS) Law	-0.306**	-0.321**	-0.252*
Dummy	(0.141)	(0.142)	(0.145)
NS Law * Initially High	0.302	0.247	0.112
Quality	(0.210)	(0.211)	(0.221)
N	1005	1005	985
Panel D: Dependent Variable: Preventable Delivery Complication Rate			
National-Standard (NS) Law	-0.383***	-0.401***	-0.401***
Dummy	(0.090)	(0.093)	(0.095)
NS Law * Initially High	0.514***	0.422***	0.418***
Quality	(0.114)	(0.124)	(0.134)
N	1035	1035	1015

Notes: robust standard errors corrected for within-state correlation in the error term are reported in parentheses. All regressions include state and year fixed effects and various state-year covariates. Regressions in Panel A are weighted by the number of admissions (for the relevant state and year) in the sub-sample of discharges associated with the relevant selected conditions (e.g., acute myocardial infarction). Regressions in Panel B are weighted by the low-variation health index (i.e., the sum of discharges for acute myocardial infarction, stroke, hip fracture or gastrointestinal bleeding) associated with each state-year cell. Regressions in Panels C and D are weighted by the number of deliveries associated with the relevant state-year cell. Inpatient mortality rates are risk-adjusted for the incidence (among the sub-sample) of each of the conditions comprising the sub-sample of selected conditions.

Source: 1979 – 2005 National Hospital Discharge Surveys.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Table B12: Summary Statistics for Covariates, Separately for Initially Low and High Quality States

	(1)	(2)
	INITIALLY LOW QUALITY STATES	INITIALLY HIGH QUALITY STATES
NON-ECONOMIC DAMAGES CAPS	0.279 (0.449)	0.291 (0.454)
PUNITIVE DAMAGE CAPS	0.255 (0.437)	0.376 (0.485)
COLLATERAL SOURCE RULE REFORMS	0.656 (0.475)	0.425 (0.494)
JOINT AND SEVERAL LIABILITY REFORM	0.483 (0.500)	0.582 (0.494)
PHYSICIAN CONCENTRATION RATE	2.239 (0.651)	2.017 (0.918)
PERCENT WHITE	0.895 (0.094)	0.842 (0.172)
PERCENT BLACK	0.070 (0.069)	0.122 (0.155)
PERCENT OTHER RACE	0.034 (0.066)	0.035 (0.082)
PERCENT ADMISSIONS COVERED BY GOVERNMENT INSURANCE	0.708 (0.097)	0.709 (0.104)
PERCENT ADMISSIONS COVERED BY PRIVATE INSURANCE	0.242 (0.095)	0.223 (0.100)
PERCENT ADMISSIONS NOT COVERED BY INSURANCE	0.032 (0.031)	0.044 (0.050)
PERCENT ADMISSIONS AT FOR-PROFIT HOSPITAL	0.050 (0.127)	0.111 (0.193)
PERCENT ADMISSIONS AT GOVERNMENT HOSPITAL	0.117 (0.171)	0.184 (0.281)
PERCENT ADMISSIONS AT NON-PROFIT HOSPITAL	0.833 (0.100)	0.705 (0.090)
PERCENT ADMISSIONS AT HOSPITALS < 100 BEDS	0.154 (0.204)	0.269 (0.306)
PERCENT ADMISSIONS AT HOSPITALS 100-200 BEDS	0.213 (0.221)	0.242 (0.301)
PERCENT ADMISSIONS AT HOSPITALS 200-300 BEDS	0.182 (0188)	0.168 (0.223)
PERCENT ADMISSIONS AT HOSPITALS 300-500 BEDS	0.285 (0.259)	0.211 (0.243)
PERCENT ADMISSIONS AT HOSPITALS 500+ BEDS	0.165 (0.199)	0.109 (0.151)

PERCENT PATIENT AGE < 30 & MALE	0.012 (0.013)	0.017 (0.033)
PERCENT PATIENT AGE < 30 & FEMALE	0.008 (0.012)	0.016 (0.059)
PERCENT PATIENT AGE 30-45 & MALE	0.034 (0.021)	0.042 (0.037)
PERCENT PATIENT AGE 30-45 & FEMALE	0.015 (0.013)	0.019 (0.020)
PERCENT PATIENT AGE 45-55 & MALE	0.063 (0.029)	0.068 (0.044)
PERCENT PATIENT AGE 45-55 & FEMALE	0.026 (0.016)	0.033 (0.028)
PERCENT PATIENT AGE 55-65 & MALE	0.093 (0.032)	0.098 (0.049)
PERCENT PATIENT AGE 55-65 & FEMALE	0.055 (0.028)	0.063 (0.041)
PERCENT PATIENT AGE 65-75 & MALE	0.126 (0.040)	0.119 (0.048)
PERCENT PATIENT AGE 65-75 & FEMALE	0.110 (0.040)	0.112 (0.051)
PERCENT PATIENT 75+ & MALE	0.168 (0.055)	0.143 (0.057)
PERCENT PATIENT AGE 75+ & FEMALE	0.292 (0.069)	0.268 (0.093)

Source: 1979 – 2005 National Hospital Discharge Surveys.

Table B13: The Relationship between National-Standard Laws and Obstetric Health Care Quality Metrics, Separately by Vaginal and Cesarean Delivery Samples

	(1)	(2)		
	CESAREAN DELIVERY SAMPLE		VAGINAL DELIVERY SAMPLE	
Panel A: Maternal Trauma Rate				
National-Standard (NS) Law Dummy	-	-	-0.318** (0.142)	-0.296 (0.184)
NS Law * Initially High Quality	-	-	0.245 (0.211)	0.390 (0.317)
Panel B: Preventable Delivery Complication Rate				
National-Standard (NS) Law Dummy	-0.081 (0.081)	-0.247*** (0.084)	-0.359*** (0.099)	-0.362*** (0.125)
NS Law * Initially High Quality	-0.203 (0.115)	-0.004 (0.196)	0.240 (0.173)	0.281 (0.281)
State-Year Covariates?	YES	YES	YES	YES
State-Specific Linear Time Trends?	NO	YES	NO	YES

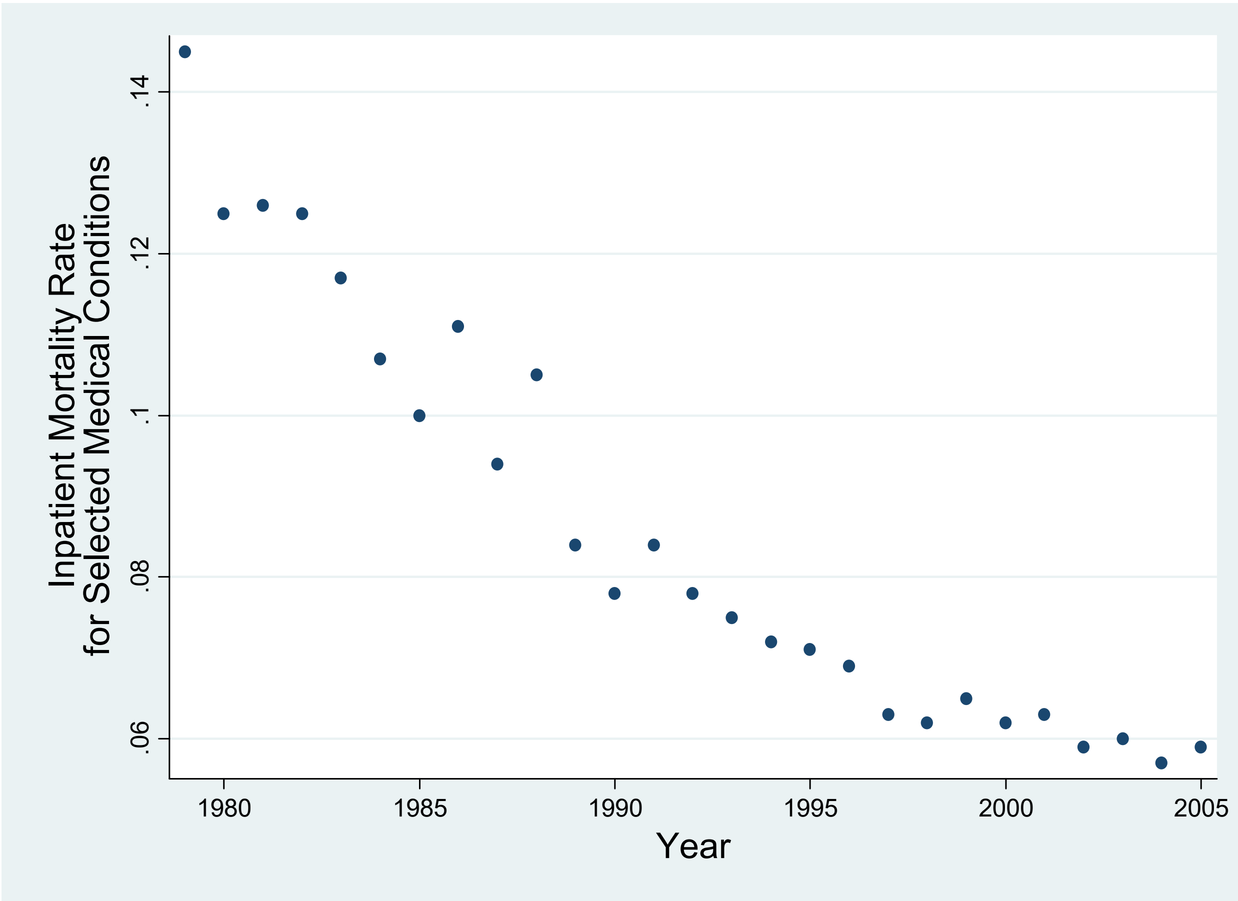
Notes: robust standard errors corrected for within-state correlation in the error term are reported in parentheses. All regressions include state and year fixed effects. Regressions are weighted by the number of deliveries associated with the relevant state-year cell.
Source: 1979 – 2005 National Hospital Discharge Surveys.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

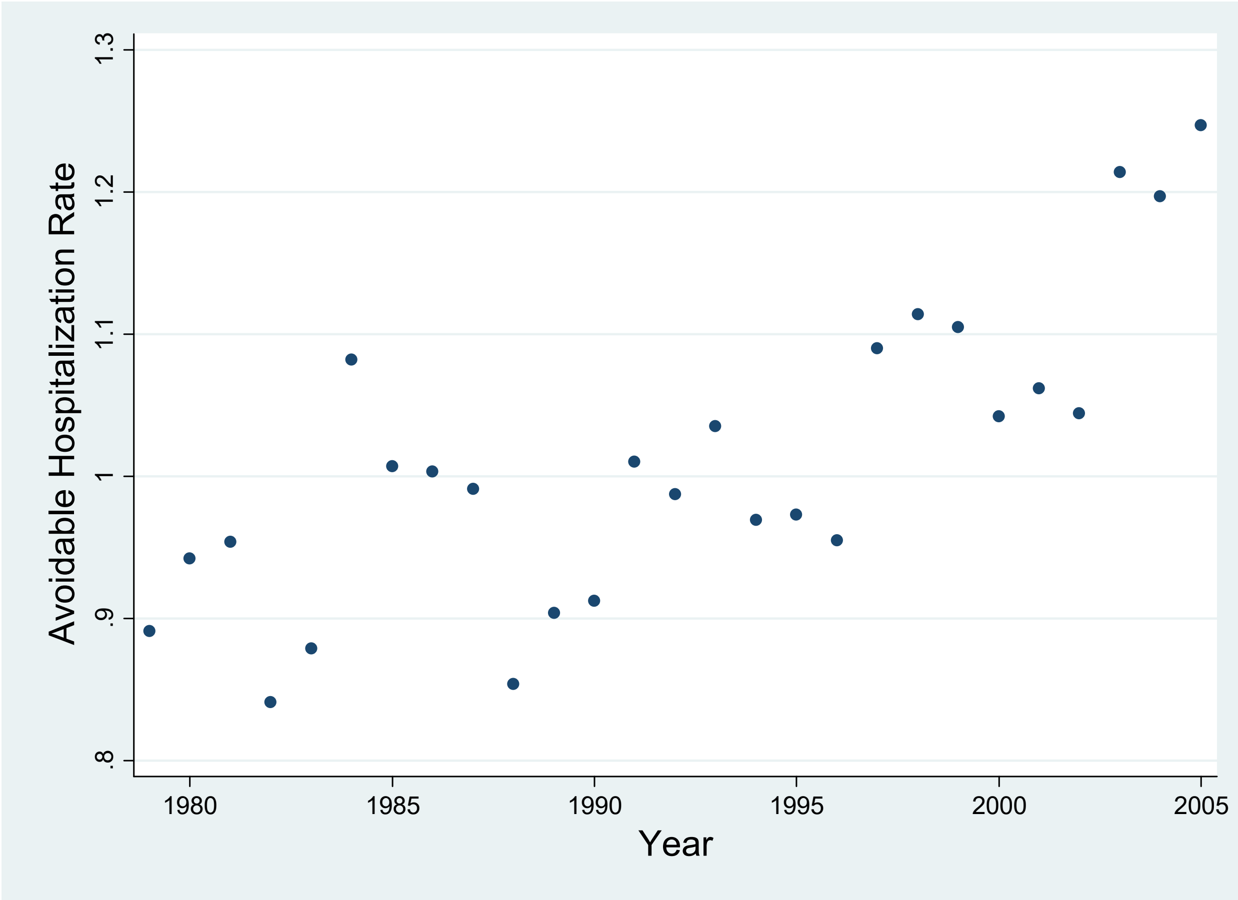
Table B14: The Relationship between National-Standard Laws and Inpatient Mortality Rates for Selected Medical Conditions, Controlling for State-Year Changes in Mean Bed Days

	(1)	(2)	(3)	(4)
National-Standard (NS) Law Dummy	-0.104*** (0.036)	-0.091** (0.036)	-0.107 (0.093)	-0.114** (0.042)
NS Law * Initially High Quality	0.174** (0.066)	0.184*** (0.064)	0.252* (0.139)	-0.170** (0.070)
State-Year Covariates?	NO	YES	YES	YES
State-Specific Linear Time Trends?	NO	NO	YES	NO
State-Specific Linear Pre-Treatment Trends?	NO	NO	NO	YES

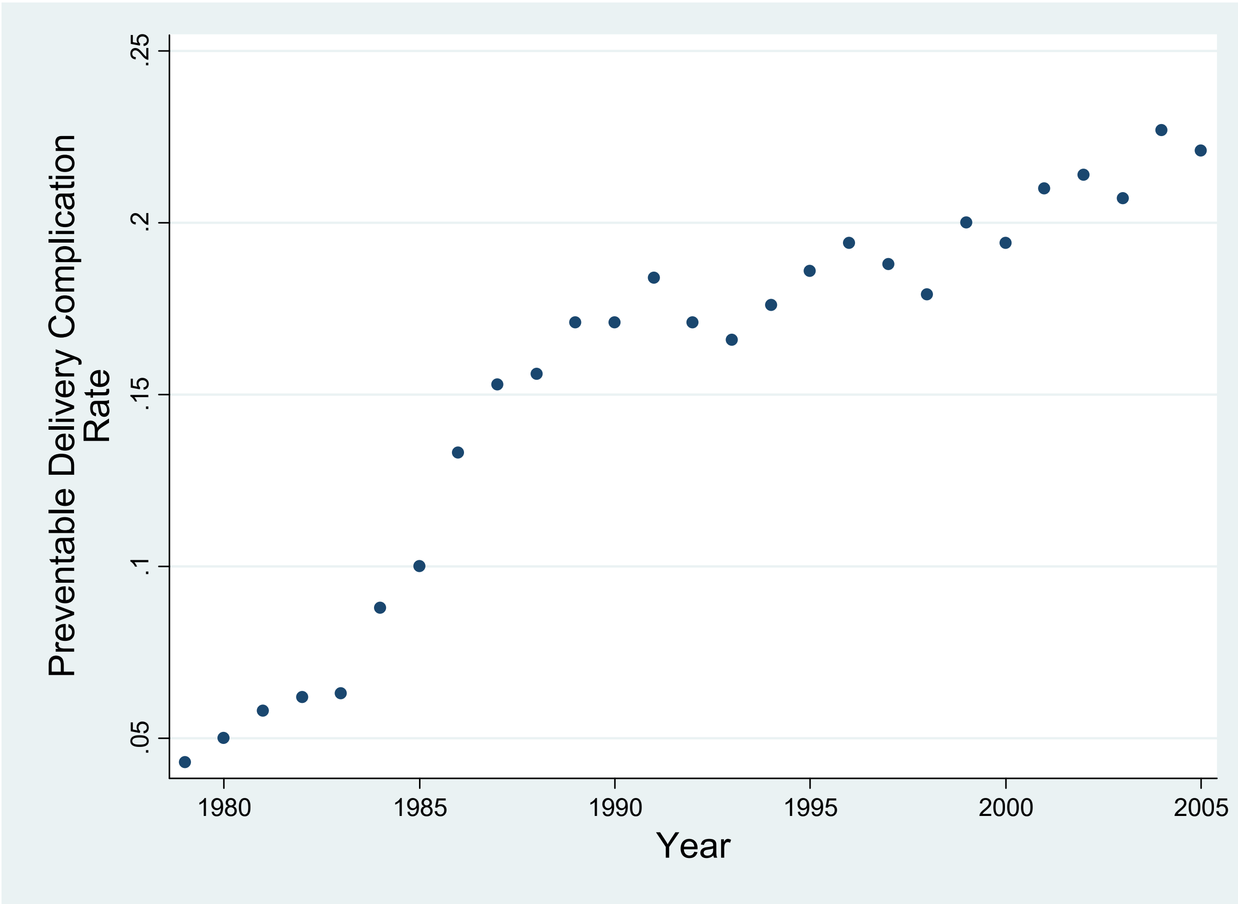
Notes: robust standard errors corrected for within-state correlation in the error term are reported in parentheses. All regressions include state and year fixed effects. Regressions are weighted by the number of admissions (for the relevant state and year) in the sub-sample of discharges associated with the relevant selected conditions (e.g., acute myocardial infarction). Inpatient mortality rates are risk-adjusted for the incidence (among the sub-sample) of each of the conditions comprising the sub-sample of selected conditions.
Source: 1979 – 2005 National Hospital Discharge Surveys.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

The following figures show year-by-year means among the NHDS sample for the various AHRQ-inspired quality indicators.

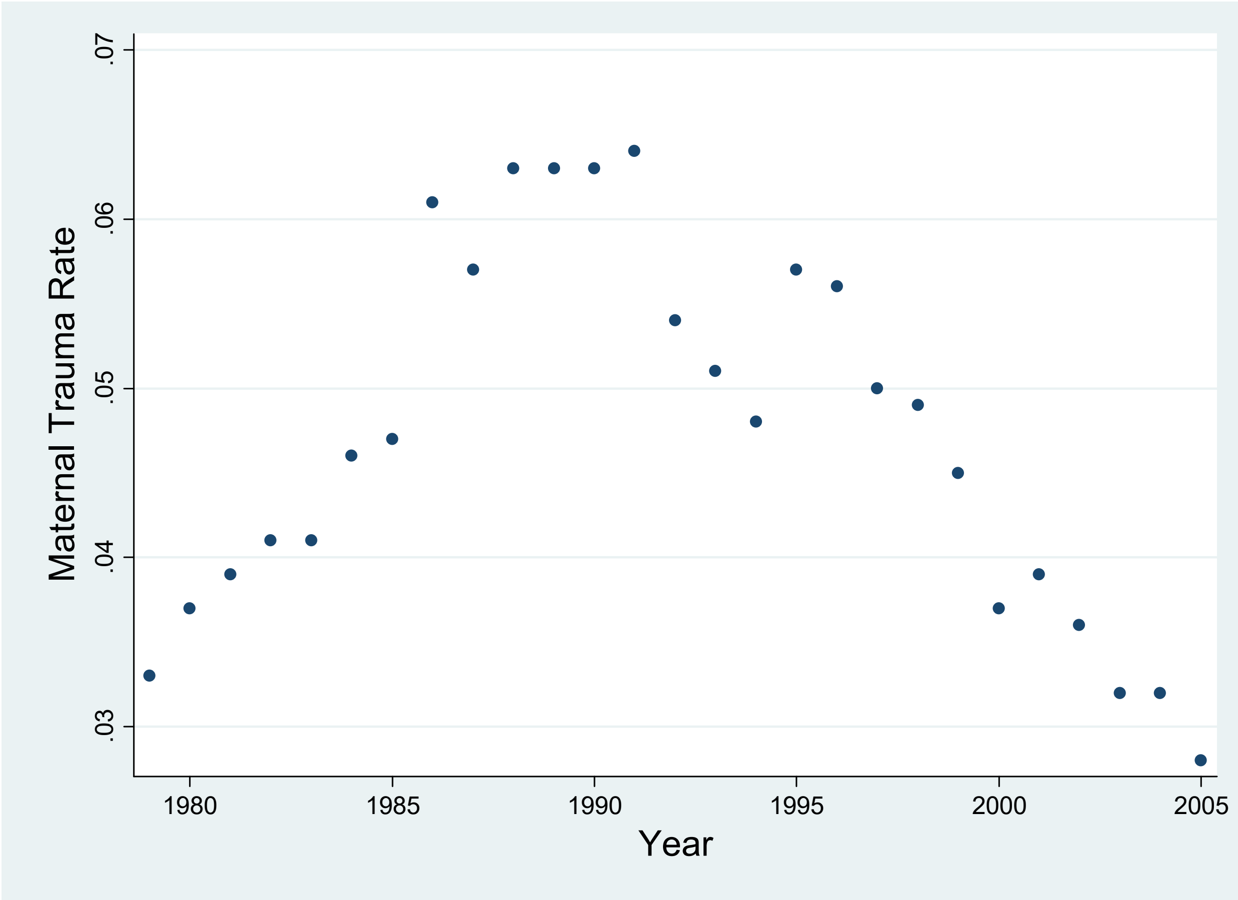




Avoidable Hospitalization Rate
.8
.9
1
1.1
1.2
1.3
1980
1985
1990
1995
2000
2005
Year



.25
.2
.15
.1
.05
Preventable Delivery Complication Rate
1980
1985
1990
1995
2000
2005
Year



Maternal Trauma Rate
.03
.04
.05
.06
.07
1980
1985
1990
1995
2000
2005
Year

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